Signal Processing Lab1

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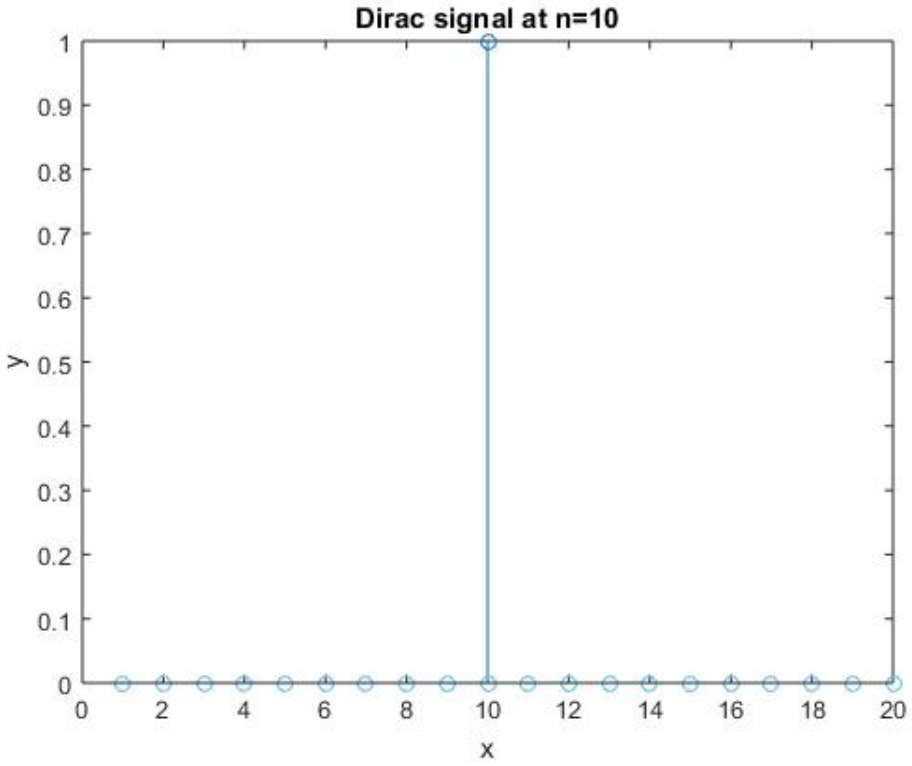
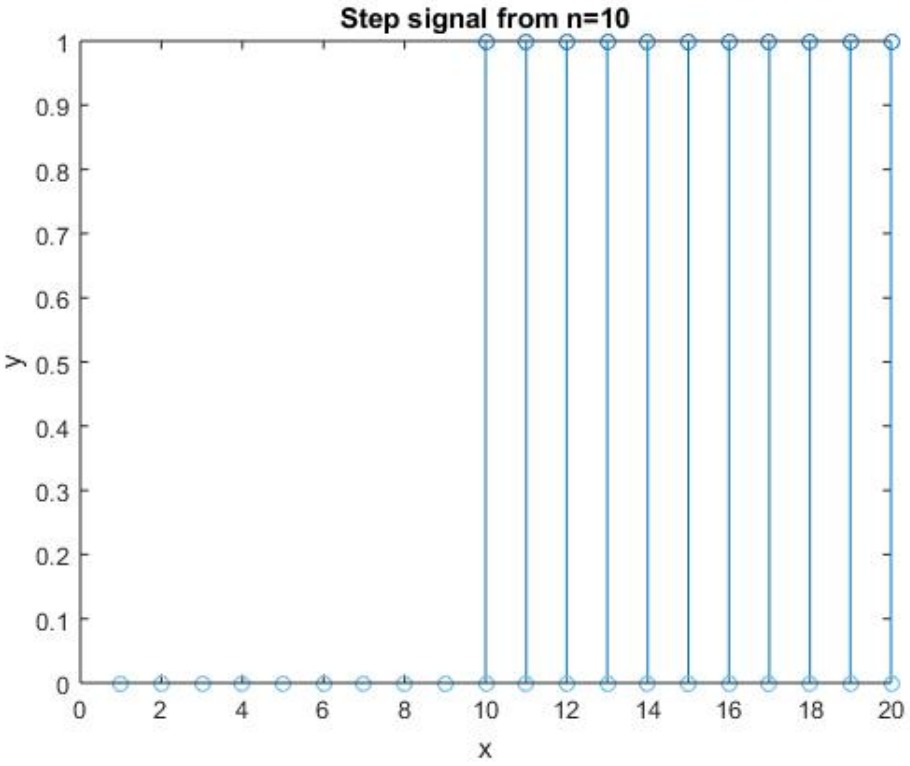
1 Problem 1

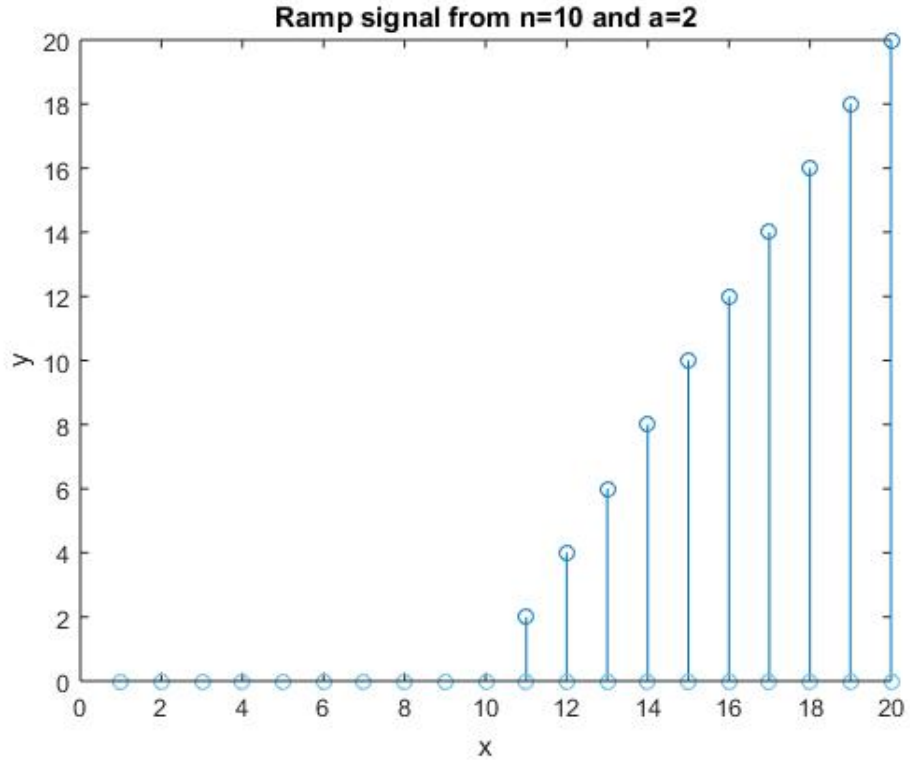
1.1 Dirac signal



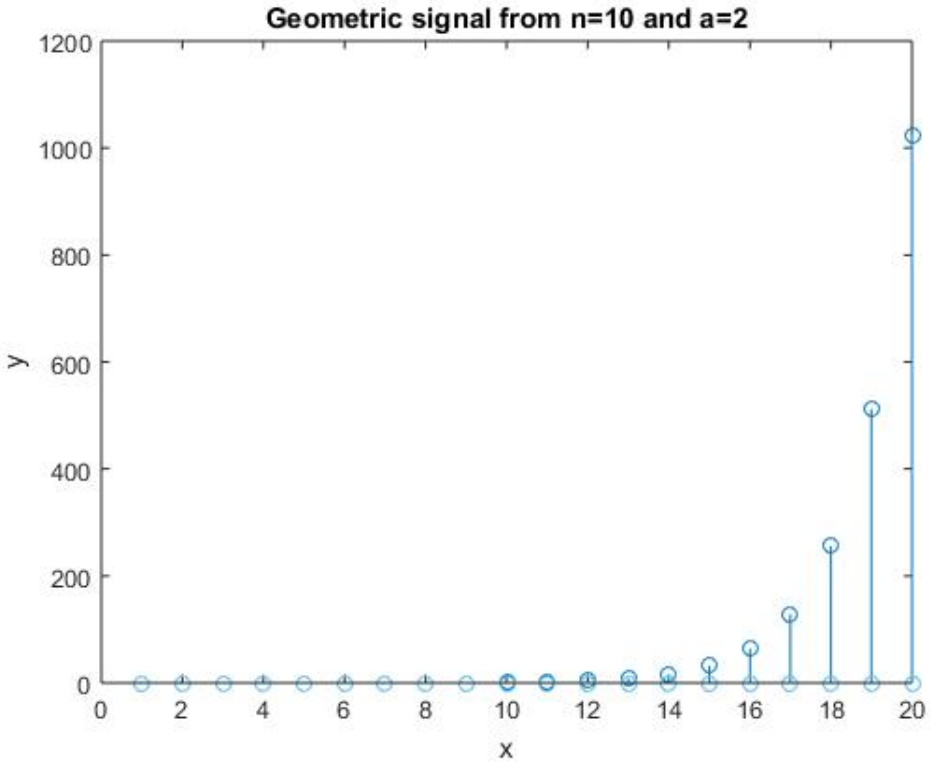
1.2 Step signal



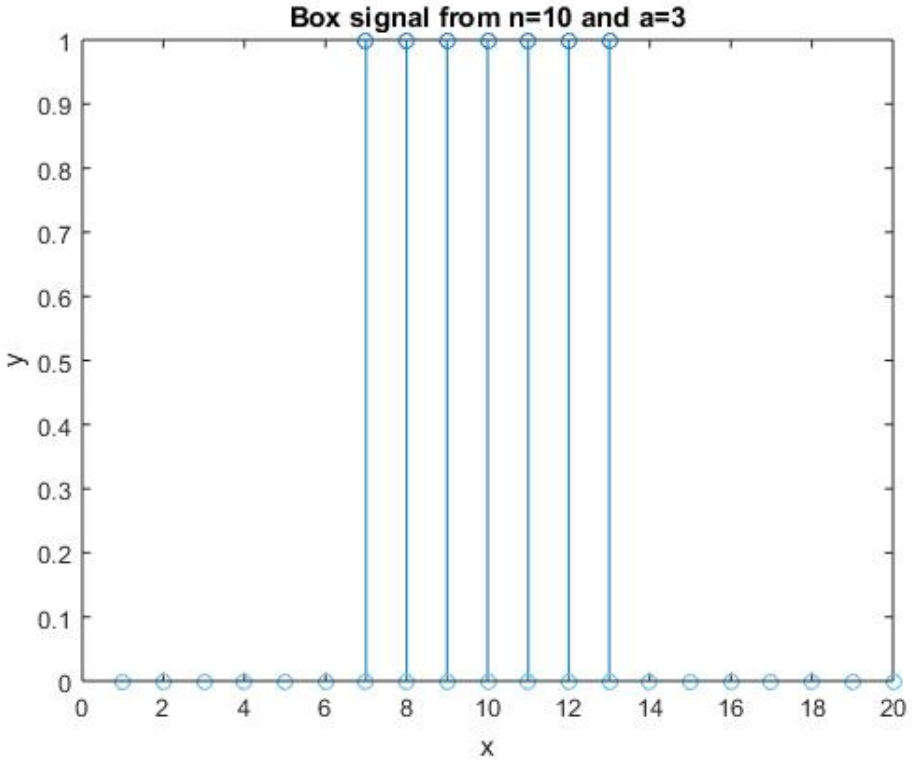
1.3 Ramp signal



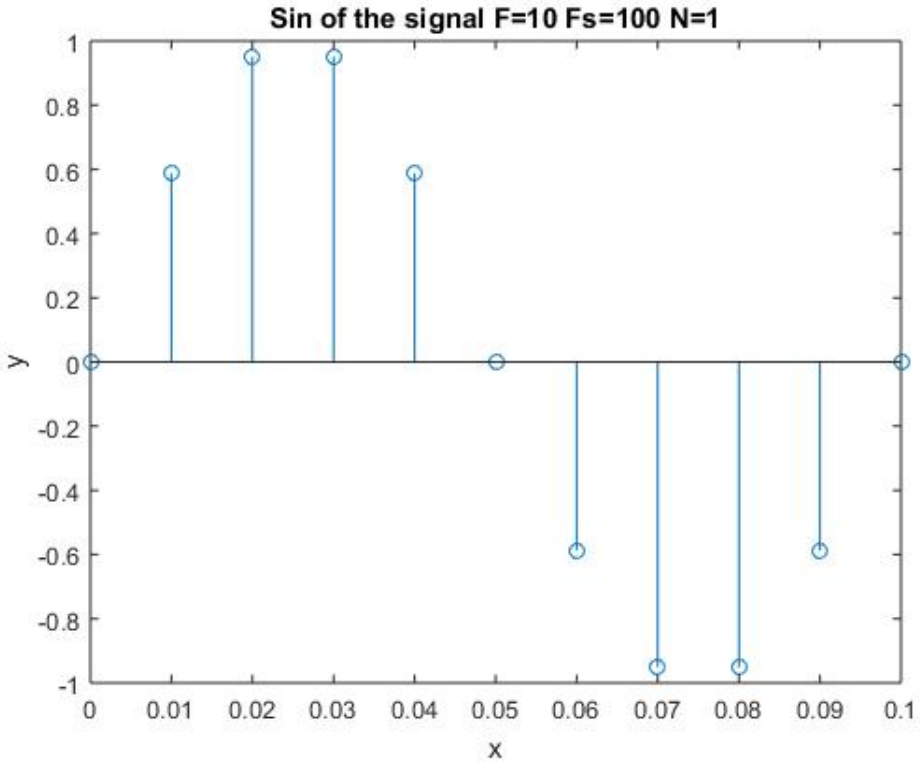
1.4 Geometric signal

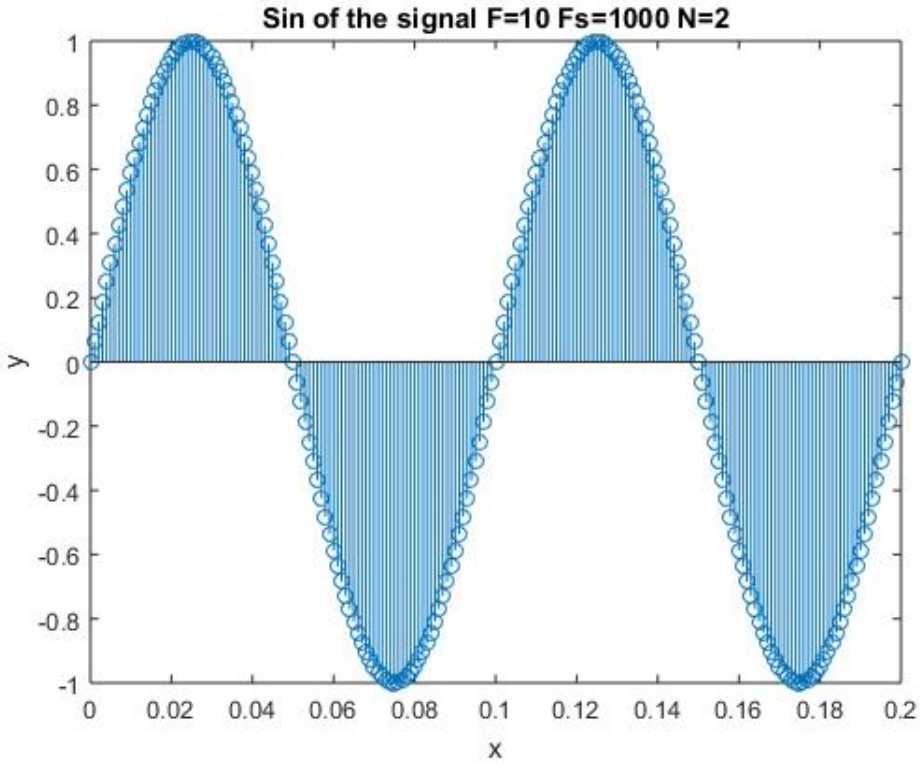


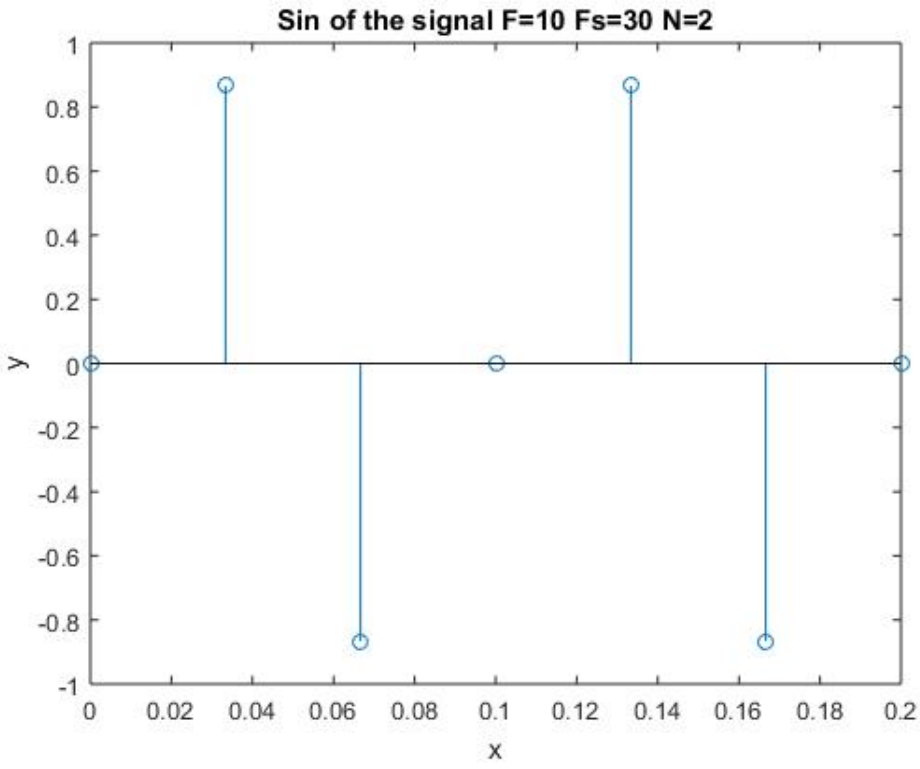
1.5 Box signal



1.6 Sine signal

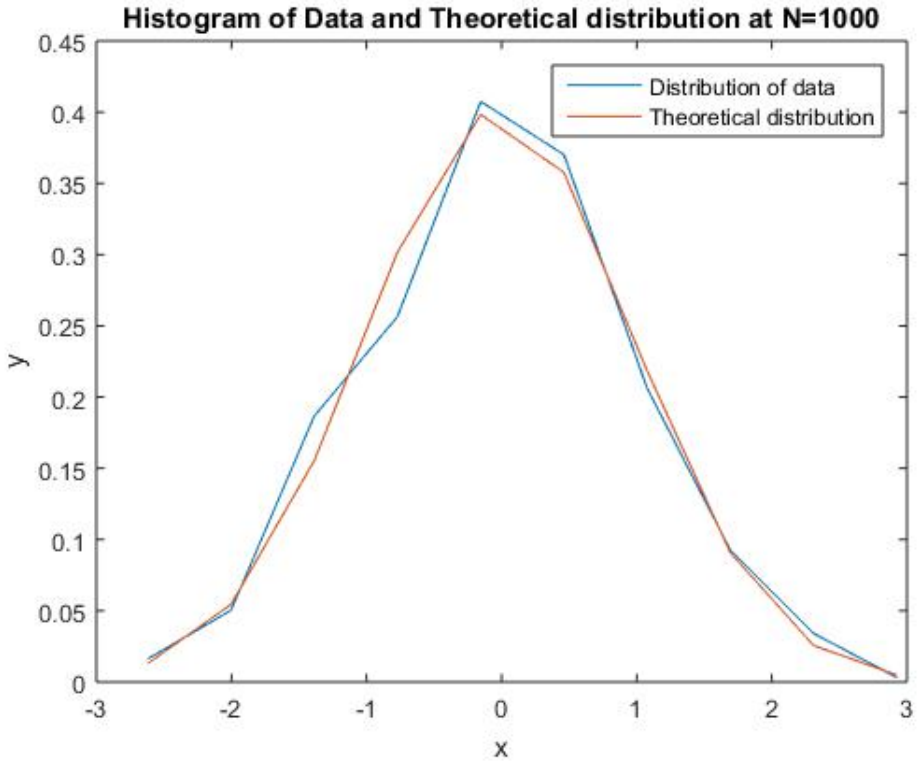


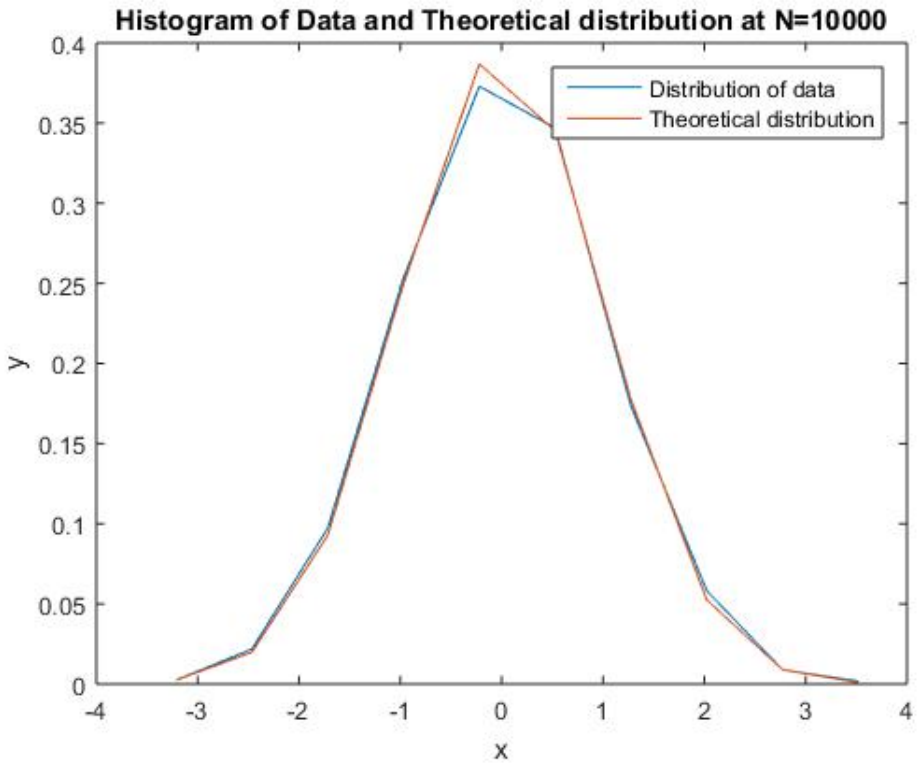




2 Random signals

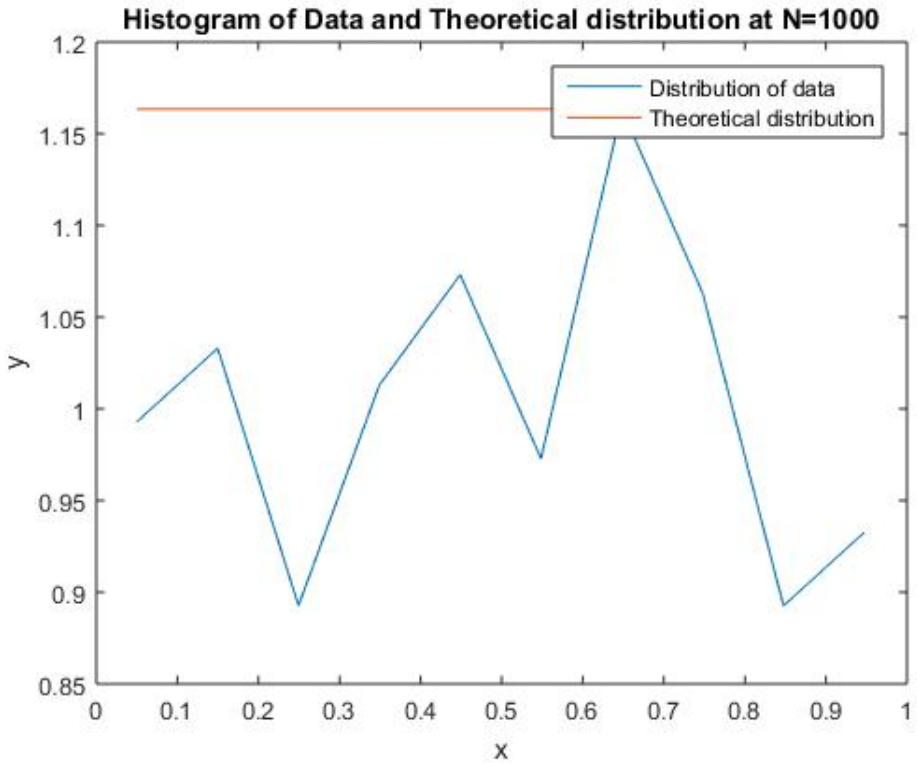
2.1 Gaussian signal

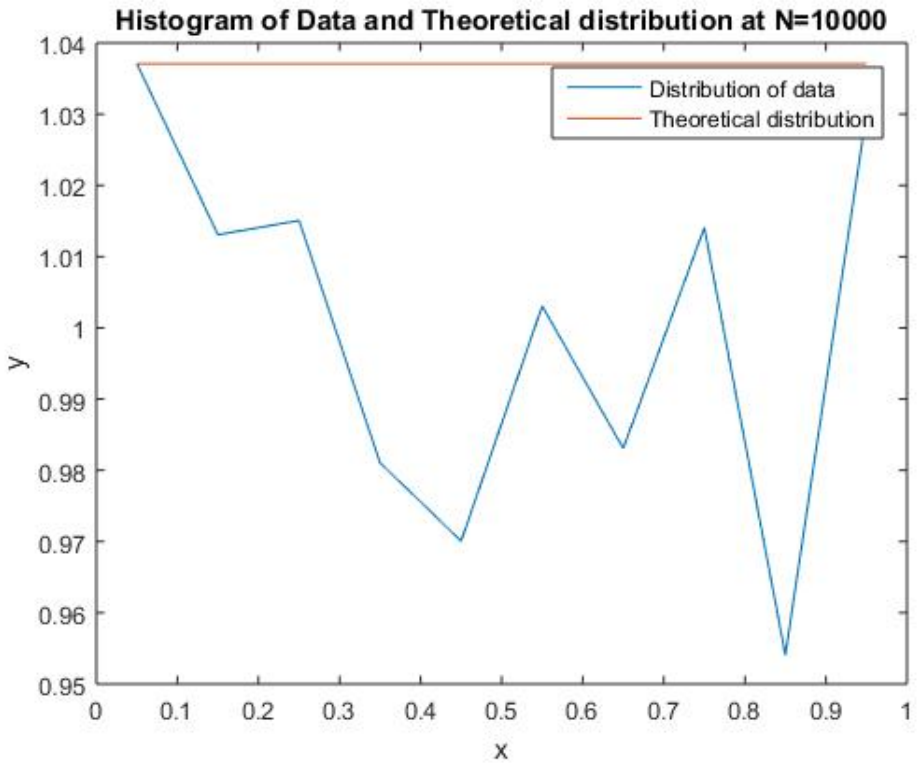




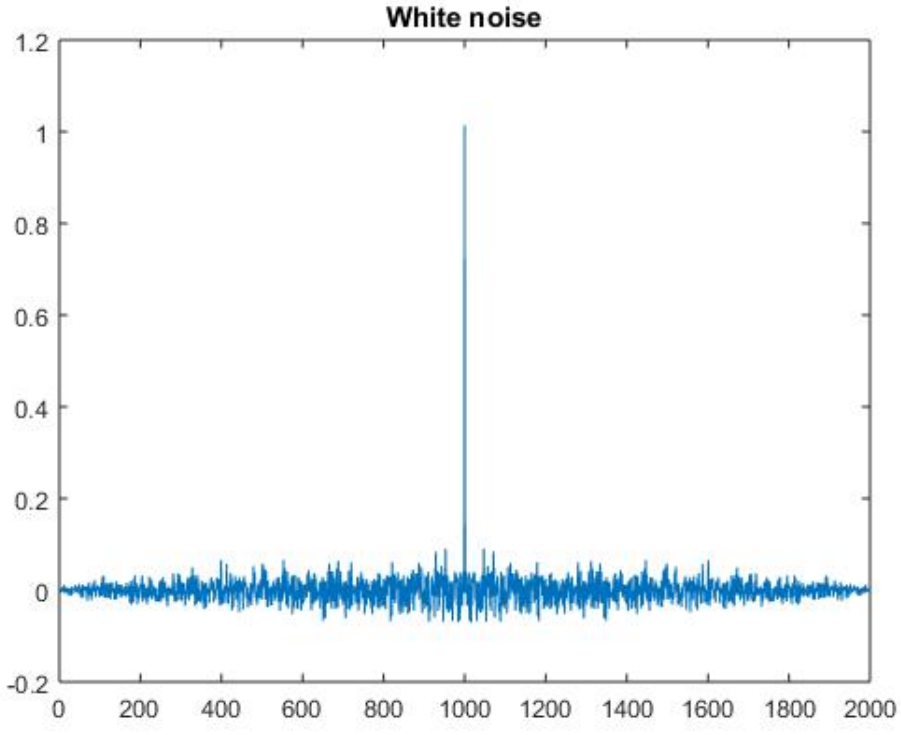
Discuss: The bigger the value of N is, the better the data fits to the theoretical Gaussian signal.

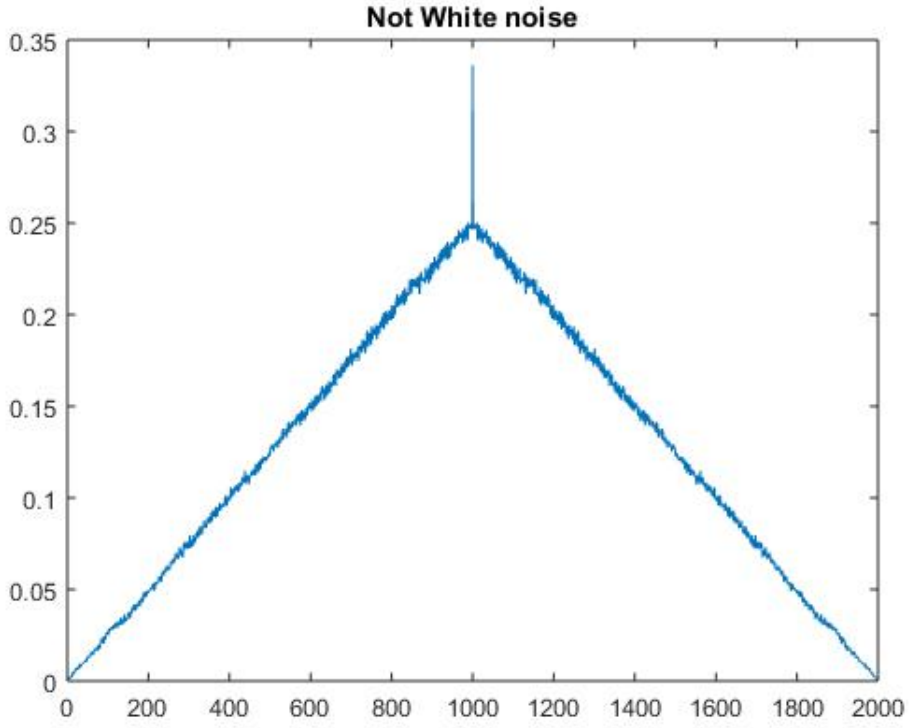
2.2 Uniform signal





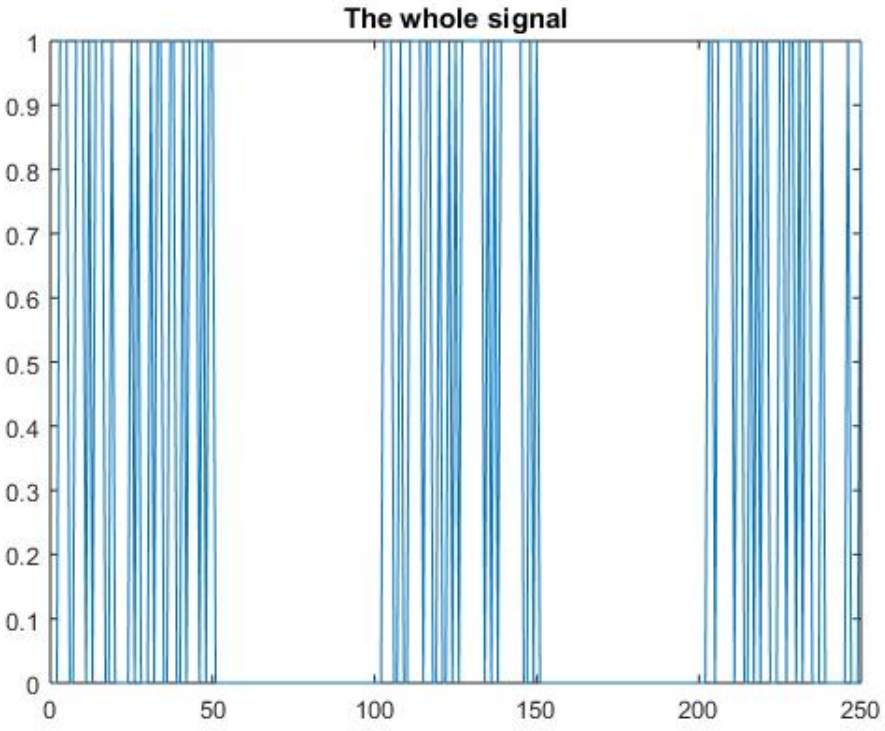
2.3 Autocorrelation

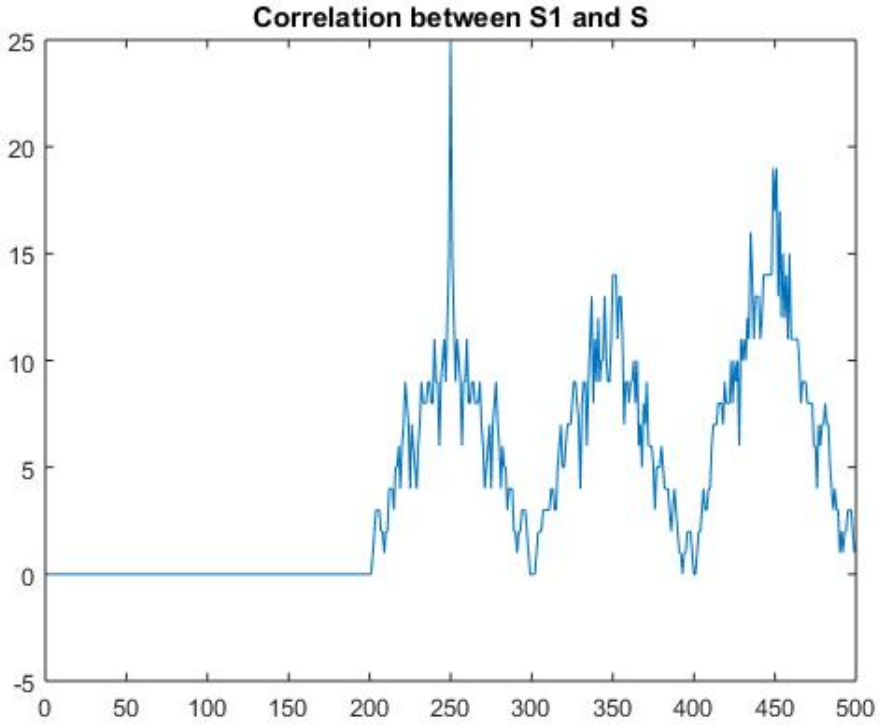


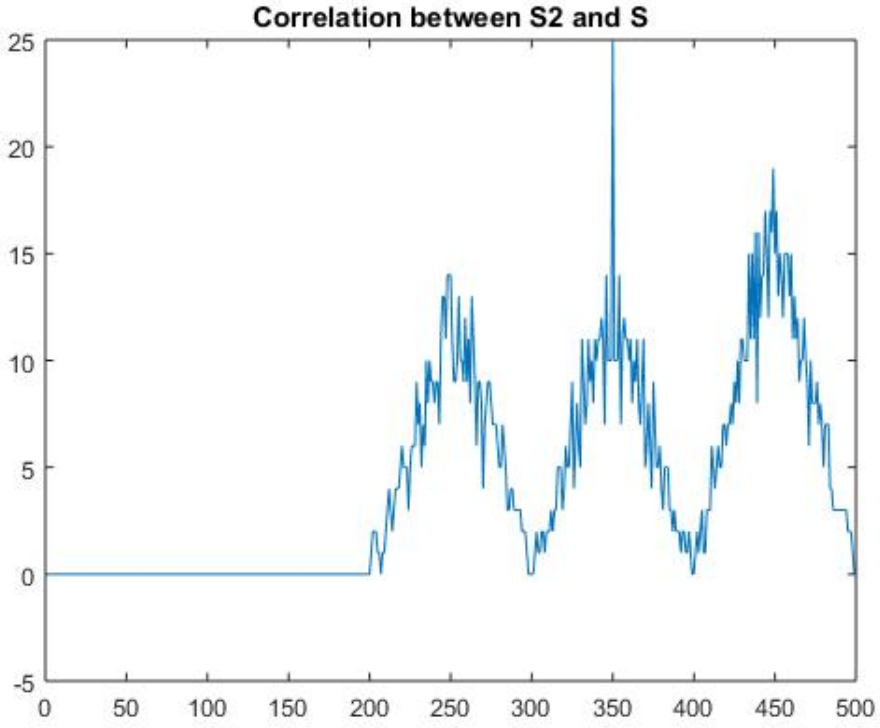


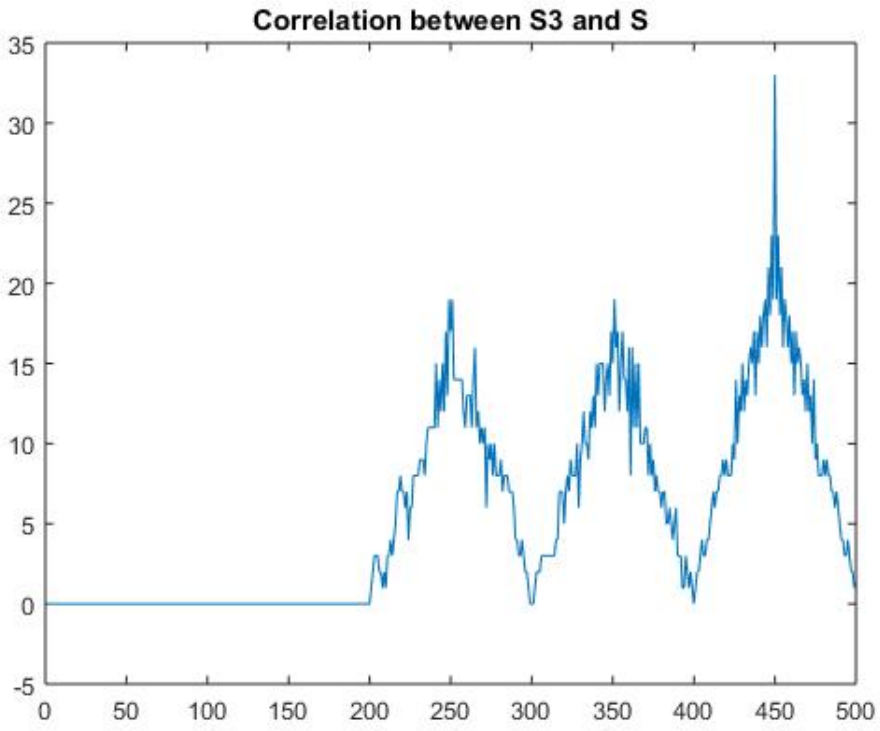
Conclusion: The autocorrelation of a continuous-time white noise signal will have a strong peak (represented by a Dirac delta function) at $\tau = 0$ and will be absolutely 0 for all other τ. Thus, the first figure represents white noise, but not the second one.

2.4 Cross-correlation




Correlation between S1 and S
25
20
15
10
5
0
-5
0
50
100
150
200
250
300
350
400
450
500


Correlation between S2 and S
25
20
15
10
5
0
-5
0
50
100
150
200
250
300
350
400
450
500



Comments the results: The cross-correlation is similar in nature to the convolution of two functions. That is why we see the pulses at signal 1, 2 and 3 when we cross-correlate signal 1, 2 and 3 with the combined signal, respectively.